

BRIEF COMMUNICATION

Farming and Prostate Cancer Among African-Americans in the Southeastern United States

Mustafa Dosemeci, Robert
N. Hoover, Aaron Blair, Larry
W. Figgs, Susan Devesa,
Dan Grauman, Joseph F.
Fraumeni, Jr.*

A remarkable epidemiologic feature of prostate cancer is its elevated mortality and incidence rates among African-Americans, who have the highest rates reported in the world (1). The reasons for this racial difference are unclear, although environmental, dietary, and hormonal factors are under study. Further clues may come from the geographic pattern within the United States.

The *Atlas of U.S. Cancer Mortality Among Nonwhites: 1950-1980* (2) reported elevated rates of prostate cancer in southeastern states, particularly since 1970 in North Carolina, South Carolina, Georgia, and Florida. Other studies (3-5) have also noted this unusual pattern of prostate cancer among nonwhites. Among whites, however, there has been a relatively even geographic distribution of mortality except for some clustering of high-rate areas in the northeast and north central states (6).

Although the environmental determinants of this pattern are unclear, it is interesting that several occupational groups have been reported to be at excess risk for developing prostate cancer. These groups include farmers, teachers, welders, metal workers, mechanics, plasterers, textile dyers, transport workers, and nitrate fertilizer workers (7-23).

Since the most consistent association has been observed among farmers (7-17), it seems possible that the increased prostate cancer rates among African-Americans in the southeast could be due at least partly to the prevalence of farming in this region.

In an initial attempt to evaluate this hypothesis, we examined death certificates from 24 states included in the National Occupational Mortality Surveillance System (24). Since 1984, mortality data have been assembled through a collaborative effort involving the National Cancer Institute, the National Institute for Occupational Safety and Health, and the National Center for Health Statistics. Occupation and industry on death certificates from the 24 states were coded using the 1980 Bureau of the Census Occupational and Industrial Classification System (25). Using data from death certificates for 1984-1991, a case-control analysis of prostate cancer and its association with the occupation of farming among African-American men was carried out for a grouping of three southeastern states (North Carolina, South Carolina, and Georgia) versus the remaining 21 states combined (Colorado, Idaho, Indiana, Kansas, Kentucky, Maine, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, Ohio, Oklahoma, Rhode Island, Tennessee, Utah, Vermont, Washington, West Virginia, and Wisconsin) (Table 1). In the analyses, farm-related occupations (i.e., farmers [codes 473 and 474], farm managers [codes 475 and 476], farm supervisors [code 477], and farm workers [code 479]) were compared with all nonagricultural occupations. Controls were selected from subjects who died of all causes except cancer. The age-adjusted (age groups 20-79 and ≥ 80 years) odds ratios for farming were almost identical (odds ratio = 1.4) for these two regions, with attributable percentages of 5.0 for the three southeastern states and 1.3 for the remaining 21 states combined.

The estimates of risk and prevalence of subjects who had farm-related occupations, along with directly measured rates of prostate cancer, allowed us to calculate the proportion of the mortality in the southeast and other states com-

bined that might be attributable to farming (Table 2). We calculated this proportion by using the analytical approach described by Hartge et al. (26). The rate difference of 6.14 per 100 000 man-years between the two regions decreased to 3.82 per 100 000 man-years (37.8% less) when cases attributable to farming were removed. These data suggest that perhaps 38% of the geographic difference in prostate cancer mortality rates among African-Americans may be explained by farm-related occupations.

Although the large size of this dataset offers advantages, the study has several limitations: (a) The study population of decedents may not accurately reflect incidence patterns of prostate cancer; (b) the quality of information on underlying cause of death may be poor, although this problem is generally less serious for prostate cancer than for other cancers (27); (c) the usual job recorded on the death certificate may be inaccurate or incomplete, although the majority of farmers appear to remain in the job for more than 20 years (28); and (d) information is lacking on other confounding factors, such as dietary habits, physical activity, or smoking. However, assuming that any potential errors in classification of disease and occupation are nondifferential, the observed result would be an underestimate of the true relative and attributable risks.

Despite its limitations, this exploratory study utilizing death certificates suggests that about 38% of the excess prostate cancer mortality among African-American men from three southeastern states compared with those from 21 states in other parts of the country may be associated with farming. These data provide further support for the association often observed between prostate cancer risk and farming occupations (29) and indicate the need for multicenter studies of prostate cancer in

*Affiliation of authors: Epidemiology and Biostatistics Program, Division of Cancer Etiology, National Cancer Institute, Bethesda, Md.

Correspondence to: Mustafa Dosemeci, Ph.D., National Institutes of Health, EPN, Rm. 418, Bethesda, MD 20892.

See "Note" section following "References."

Table 1. Age-adjusted (age groups 20-79 and ≥80 years) odds ratios and attributable risks of prostate cancer among African-American farmers in three southeastern states compared with those in 21 other states, 1984-1991

Region	No. of prostate cancer cases	No. of controls	Odds ratio (95% confidence interval)	Attributable risk (95% confidence interval)
21 states*				
Farm-related occupations	228	3093	1.39 (1.2-1.6)	1.3 (0.7-2.0)
All other occupations	4536	112 927		
Three southeastern states†				
Farm-related occupations	891	13 620	1.40 (1.3-1.5)	5.0 (3.6-6.3)
All other occupations	3904	98 825		

*Colorado, Idaho, Indiana, Kansas, Kentucky, Maine, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, Ohio, Oklahoma, Rhode Island, Tennessee, Utah, Vermont, Washington, West Virginia, and Wisconsin.

†North Carolina, South Carolina, and Georgia.

Table 2. Prostate cancer rate differences among African-Americans before and after subtraction of attributable risk of farming

Description	Three southeastern states	Twenty-one remaining states	Difference between the two regions
Prostate cancer mortality rate* during 1980-1989 before subtraction of attributable percent	60.66	54.52	6.14
Attributable percent for farmers	5.0	1.3	3.7
Prostate cancer mortality rate attributable to farmers	3.03	0.71	2.32
Prostate cancer mortality rate after subtraction of attributable rate	57.63	53.81	3.82
Percent contribution of farming on excess risk of prostate cancer rate in three southeastern states	$\frac{6.14 - 3.82}{6.14} \times 100 = 37.8\%$		

*Per 100 000 man-years, age-adjusted using the 1980 U.S. standard population.

high-risk areas and populations to clarify the role of specific agricultural exposures (e.g., pesticides) and other environmental or lifestyle factors that may be linked to farming.

References

- (1) Muir C, Waterhouse J, Mack T, et al: Cancer Incidence in Five Continents. Vol V. IARC Sci Publ No. 88. Lyon: IARC, 1987
- (2) Pickle LW, Mason TJ, Howard N, et al: Atlas of U.S. Cancer Mortality Among Non-whites: 1950-1980. DHHS Publ No. (NIH)90-1582. Bethesda, Md: NCI, 1990
- (3) Blair A, Fraumeni JF Jr: Geographic patterns of prostate cancer in the United States. *J Natl Cancer Inst* 61:1379-1384, 1978
- (4) Lee JY, Soong SJ: Cancer mortality in the South, 1950 to 1980. *South Med J* 83:185-190, 1990
- (5) Robertson C, Demark-Wahnefried W, Aldrich T: Prostate cancer in North Carolina. *N C Med J* 53:447-451, 1992
- (6) Pickle LW, Mason TJ, Howard N, et al: Atlas of U.S. Cancer Mortality Among Whites: 1950-1980. DHHS Publ No. (NIH)87-2900. Bethesda, Md: NCI, 1987
- (7) Burmeister LF, Everett GD, Van Lier SF, et al: Selected cancer mortality and farm practices in Iowa. *Am J Epidemiol* 118:72-77, 1983
- (8) Gallagher RP, Threlfall WJ, Jeffries E, et al: Cancer and aplastic anemia in British Columbia farmers. *J Natl Cancer Inst* 72:1311-1315, 1984
- (9) Blair A, Malker H, Cantor KP, et al: Cancer among farmers. A review. *Scand J Work Environ Health* 11:397-407, 1985
- (10) Checkoway H, DiFerdinando G, Hulka BS, et al: Medical, life-style, and occupational risk factors for prostate cancer. *Prostate* 10:79-88, 1987
- (11) Saftlas AF, Blair A, Cantor KP, et al: Cancer and other causes of deaths among Wisconsin farmers. *Am J Ind Med* 11:119-129, 1987
- (12) Brownson RC, Reif JS, Chang JC, et al: Cancer risks among Missouri farmers. *Cancer* 64:2381-2386, 1989
- (13) Reif J, Pearce N, Fraser J: Cancer risks in New Zealand farmers. *Int J Epidemiol* 18:768-774, 1989
- (14) van der Gulden JW, Kolk JJ, Verbeek AL: Prostate cancer and work environment [see comment citation in Medline]. *J Occup Med* 34:402-409, 1992
- (15) Blair A, Zahm SH, Pearce NE, et al: Clues to cancer etiology from studies of farmers. *Scand J Work Environ Health* 18:209-215, 1992
- (16) Fincham SM, Hanson J, Berkel J: Patterns and risks of cancer in farmers in Alberta. *Cancer* 69:1276-1285, 1992
- (17) Morrison H, Savitz D, Semenciw R, et al: Farming and prostate cancer mortality. *Am J Epidemiol* 137:270-280, 1993
- (18) Pearce NE, Sheppard RA, Fraser J: Case-control study of occupation and cancer of the prostate in New Zealand. *J Epidemiol Commun Health* 41:130-132, 1987
- (19) Dubrow R, Wegman DH: Cancer and occupation in Massachusetts: a death certificate study. *Am J Ind Med* 6:207-230, 1984
- (20) Simonato L, Fletcher AC, Andersen A, et al: A historical prospective study of European stainless steel, mild steel, and shipyard welders. *Br J Ind Med* 48:145-154, 1991
- (21) Siemiatycki J, Gerin M, Dewar R, et al: Associations between occupational circumstances and cancer. In *Risk Factors for Cancer in the Workplace* (Siemiatycki J, ed). Boca Raton, Fla: CRC Press, 1991
- (22) Williams RR, Stegens NL, Goldsmith JR: Associations of cancer site and type with occupation and industry from the Third National Cancer Survey Interview. *J Natl Cancer Inst* 59:1147-1185, 1977
- (23) Hagmar L, Bellander T, Andersson C, et al: Cancer morbidity in nitrate fertilizer workers. *Int Arch Occup Environ Health* 63:63-67, 1991
- (24) Blair A, Dosemeci M, Heineman E: Cancer and other causes of death among male and female farmers from twenty-three states. *Am J Ind Med* 23:729-742, 1993
- (25) US Bureau of the Census: 1980 Census of Population: Alphabetical Index of Industries and Occupations. Washington, DC: US Govt Print Off, 1982
- (26) Hartge P, Harvey EB, Linehan WM, et al: Unexplained excess risk of bladder cancer in men. *J Natl Cancer Inst* 82:1636-1640, 1990
- (27) Percy CL, Miller BA, Gloeckler-Ries LA: Effect of changes in cancer classification and the accuracy of cancer death certificates in cancer mortality. *Ann N Y Acad Sci* 609:87-97 [discussion 97-99], 1990
- (28) Cooper SP, Buffler PA, Lee ES, et al: Health characteristics by longest held occupation and industry of employment: United States, 1980. *Am J Ind Med* 24:25-39, 1993
- (29) Blair A, Zahm SH: Cancer among farmers. *Occup Med* 6:335-354, 1991

Note

Manuscript received June 13, 1994; revised September 6, 1994; accepted September 13, 1994.